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PATENT ABSTRACTS OF JAPAN

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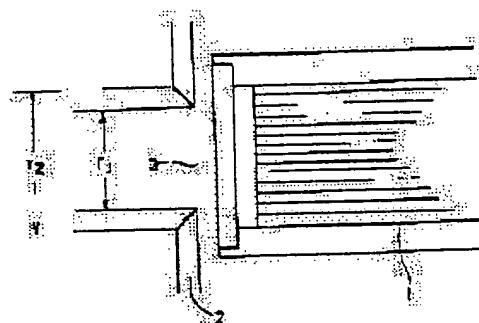
(21)Application number : 10-126632 (71)Applicant : OLYMPUS OPTICAL CO LTD
(22)Date of filing : 22.04.1998 (72)Inventor : TOMIOKA MAKOTO

(54) ENDOSCOPE LIGHT SOURCE DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To supply light for sufficient quantity even in the case of use for an endoscope provided with a thin light guide by providing a light quantity cut mask for limiting the quantity of incident light near the incidence plane of the light guide.

SOLUTION: Near the incidence end of a light guide 1, a light quantity cut mask 2 for limiting the quantity of light made incident to the light guide 1 is provided just before the incidence end of the light guide 1. Thus, light from a light source lamp is made incident through an opening part 3 of the light quantity cut mask 2 to the light guide 1. A high-luminance 150 W metal halide lamp is used for the light source lamp so as to supply light for sufficient quantity even in the case of using the light guide 1 for the endoscope. Since the light quantity cut mask 2 is provided so that the light made incident through the opening 3 to the light guide 1 does not exceed quantity more than a fixed level because of the light quantity cut mask 2 even in the case of use for the endoscope of a thick light guide 1, however, any problem such as heating at the top end of the endoscope does not occur.



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CLAIMS

[Claim(s)]

[Claim 1] Endoscope light equipment characterized by having arranged the quantity of light cut mask for restricting [in / outgoing radiation and the endoscope light equipment to illuminate / for the outgoing radiation light from a light source lamp] the amount of incident lights to a light guide to a photographic subject near the incidence end face of the aforementioned light guide through a light guide just before the incidence edge of the aforementioned light guide.

[Claim 2] Endoscope light equipment of the claim 1 characterized by making the aforementioned quantity of light cut mask composition in which the amount of incident lights to the aforementioned light guide becomes 2000 lumens or less.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the endoscope light equipment for supplying lighting light to the light guide for lighting of an endoscope lighting system.

[0002]

[Description of the Prior Art] In recent years, the long and slender insertion section is made to insert into a coelome, a coelome viscus machine is observed or the endoscope which can perform various curative treatment using the disposal implement inserted into the disposal implement channel if needed is used widely.

[0003] The light guide which this endoscope leads the lighting light by which outgoing radiation was carried out from external light equipment to the insertion section, carries out outgoing radiation towards a photographic subject, and illuminates this is prepared.

[0004] The light equipment used here has the optical system for condensing the light which carries out outgoing radiation from a light source lamp, and leading to the incidence end face of a light guide.

[0005] The light guide which there is a thing of various sizes and is used for an endoscope also changes with endoscopes, and the size of an endoscope is also various. Generally, although a light guide is also thick and sufficient quantity of light for observation is obtained, in the case of a narrow endoscope, the light guide of a thick endoscope is also thin, and quantity of light sufficient for the reason is not obtained. Thus, although the f number of observation optical system is made into smallness and it is made to obtain luminosity sufficient as the whole endoscope system when quantity of light with it is not obtained, depth of field produce the fault which is not enough. [a thin light guide and] [sufficient]

[0006] Moreover, although light source lamps, such as a xenon, metal halide, and a halogen, are used for endoscope light equipment, there is a life in these light source lamp. Therefore, the light source lamp built in endoscope light equipment is turned off in the midst of inspection by the endoscope etc., and un-arranging of having to stop having to close inspection etc. starts.

[0007] In order to lose this un-arranging, when a light source lamp is turned off to light equipment, the light equipment which put the emergency light lamp side by side is known so that it can continue supplying lighting light to a lighting system. Such conventional endoscope light equipment with a built-in emergency light lamp consists of the reflective mirrors 22 and the source lamps 21 of emergency light photometry which are inserted into the optical path of main light source side 20, as shown in drawing 5, and it reflects the flux of light for lighting by the reflective mirror 22 with the source lamp of emergency light photometry, and it is made to lead it to the incidence end face of a light guide.

[0008]

[Problem(s) to be Solved by the Invention] It is possible to use the high intensity lamp of high power for the increase in the quantity of light to the endoscope using the narrow diameter light guide. However, when the light equipment using such a high intensity lamp is applied to the endoscope using the thick light guide, the quantity of light which carries out outgoing radiation from an endoscope nose of cam becomes size, and generation of heat by the endoscope point becomes a

problem.

[0009] There are various kinds of the light equipment used by the endoscope system, and the outgoing radiation quantity of lights also differ in each light equipment. Therefore, what is necessary is just to use a narrow light guide in accordance with the light equipment using the lamp of high brightness, in order to avoid the problem of generation of heat by the endoscope point. However, since the lighting quantity of light will run short and it will become dark if the light equipment of the lamp of low brightness is combined and used for the endoscope using such a narrow light guide, it cannot be used, and it is not desirable as the whole endoscope system.

[0010] Therefore, when it not only makes it the shortage of the quantity of light not arise, but combines with the endoscope using the thick light guide in the narrow endoscope especially using the narrow light guide combining the light equipment using the lamp of high brightness, it is necessary to make it the problem of generation of heat not arise, as lighting light of the quantity of light more than a constant rate is not supplied.

[0011] Moreover, in light equipment equipped with the above emergency light lamps, there was a fault that sufficient NA was not securable to a light guide, in the conventional equipment which inserts a reflective mirror into the optical path of the main light source as shown in drawing 5.

[0012] In light equipment equipped with the conventional emergency light lamp shown in drawing 5, in order to make the incidence end face of a light guide condense the flux of light which carries out outgoing radiation from the emergency light lamp 21, as shown in (B), using the ellipsoid mirror 23 as shown in (A) of drawing 5, it is necessary to use a condenser lens 24. When such the ellipsoid mirror 23 and a condenser lens 24 are used, sufficient optical path length is needed and all have the fault which cannot secure sufficient NA to NA of a light guide.

[0013] Moreover, in the light equipment shown in drawing 5, in order to secure sufficient NA to an emergency light side, not only an emergency light side but the main light source side becomes large-sized, and light equipment itself has the fault which becomes large-sized.

[0014] Therefore, when the main light source side lamp stops lighting up and it uses an emergency light lamp, in order that, as for the conventional example shown in drawing 5, the whole observation visual field not only becomes dark, but may carry out incidence only of the low flux of light of NA to NA of a light guide, the observation visual field circumference becomes dark.

[0015] Therefore, there is a fault -- only an inadequate inspection result is obtained that it is hard to perform observation with a clear image in the cases, such as observation with an endoscope.

[0016] this invention offers the light equipment which the problem of generation of heat does not produce, when it is used for the endoscope equipped with the narrow light guide, and when it is used for the endoscope equipped with the thick light guide possible [supply of sufficient quantity of light].

[0017] Moreover, this invention is the thing equipped with the emergency light lamp used when lighting of the main lamp is impossible, when it switches an emergency light, it can supply sufficient quantity of light and sufficient light of NA to the light guide for lighting, and it offers the light equipment of compact composition.

[0018]

[Means for Solving the Problem] Incidence of the light equipment for endoscopes of this invention is carried out to a light guide from the plane of incidence from a light source lamp, and it is characterized by arranging the quantity of light cut mask for restricting the amount of incident lights near the plane of incidence of a light guide in the lighting system for endoscopes which is transmitted by this light guide, is made to carry out outgoing radiation from the outgoing radiation side, and illuminates a photographic subject.

[0019] It is characterized by making it the amount of incident lights to a light guide not exceed 2000 lumens (lumen) with the quantity of light cut mask for restricting especially the amount of incident lights.

[0020] that is, when using the light equipment of this invention as an object for endoscopes which has a narrow light guide, sufficient quantity of light is obtained -- as -- high, while using a brightness lamp In case incidence is carried out to a narrow light guide, when it is the area of opening which it does not have at all and incidence of the operation which intercepts light is moreover carried out to a thick light guide It is characterized by using the quantity of light cut mask which has the area of

opening which can restrict the amount of incident lights to the grade from which generation of heat of an endoscope point does not become a problem, securing sufficient luminosity for the amount of incident lights by intercepting a part of light of the light source.

[0021] this invention will be because it checked that the amount of incident lights could be restricted to the value of simultaneously regularity, if the path of a light guide exceeds constant value by having been made based on the result which measured the amount of incidence to the light guide from which a path differs using the quantity of light cut mask of the area (path of opening) of fixed opening, and using this quantity of light cut mask so that it may explain in detail based on the form of operation later.

[0022] Furthermore, as a result of measuring change of the calorific value of the endoscope point by increase of the amount of incident lights, when the amount of incident lights exceeds 2000 lumens, it is what calorific value became size and found out that it was not desirable on use, therefore it is most desirable to consider as the grade to which the amount of incident lights does not exceed about 2000 lumens using a quantity of light cut mask.

[0023] Moreover, the light equipment for endoscopes of this invention is set to the endoscope lighting system which make carry out incidence of the outgoing radiation light from light equipment, it is made to transmit and carry out outgoing radiation from the plane of incidence of a light guide, and illuminates a photographic subject. It is the thing equipped with the emergency light inserted between a light source lamp and a light guide, and this emergency light consists of a light source lamp and condensing optical system, and condensing optical system is characterized by making the path of the direction more nearly right-angled than the longitudinal direction of the bulb of a light source lamp to a longitudinal direction into size.

[0024] NA of the light which carries out incidence of the condensing optical system of an emergency light to the light guide of the light condensed by this right-angled direction by having made it size in the path of the longitudinal direction of the bulb of a light source lamp and a right-angled direction is made for the light equipment of this this invention to seldom become smallness to NA of a light guide, for example, it was made to become 70 percent or more.

[0025] By this, when it switches to an emergency light, comparatively big NA is maintained, moreover, there is no emergency light with a bird clapper on a large scale, it is compact and a switch can make in easy composition.

[0026]

[Embodiments of the Invention] Next, the form of operation of the light equipment of this invention is explained based on a drawing.

[0027] Drawing 1 is drawing in which showing the form of operation of the 1st of this invention, and showing near the incidence end face of the light guide used for the endoscope of the light equipment of this invention, and on usual light equipment and substance, since it is the same, the composition of a light source lamp etc. has been omitted.

[0028] In this drawing 1 , when 1 combines a light guide and 2 combines light equipment, it is the quantity of light cut mask located near the incidence end face of this light guide 1, and in the light guide 1 of this quantity of light cut mask 2, the light source lamp which is not illustrated is located in an opposite side, and the light from this lamp carries out incidence to a light guide 1 through the opening 3 of a quantity of light cut mask.

[0029] High brightness 150W metal halide lamp is used so that the light source lamp used with the light equipment of the form of this operation can supply sufficient quantity of light also to the endoscope of a narrow light guide.

[0030] When it uses for the endoscope of a narrow light guide by using such a lamp (lamp whose quantity of light is size enough) of high brightness, sufficient quantity of lighting light can be supplied. Moreover, since it may be made for the light which passes the opening 3 with the quantity of light cut mask 2, and carries out incidence to a light guide 1 not to become the quantity of light more than fixed when it is used as an object for the endoscopes of the thick light guide of a path by having the quantity of light cut mask 2, the problem of generation of heat of an endoscope point is not produced.

[0031] And in the case of the form of this operation, it is able to make it, even if the path of a light guide becomes size by setting the path of a quantity of light cut mask to 3.7mm not to exceed 2000

lumens.

[0032] Drawing 2 is a graph which shows the path R of a light guide, and a relation with the quantity of light I. When a does not use a quantity of light cut mask in this graph, b shows the case where a quantity of light cut mask is used. As shown in this drawing, if a quantity of light cut mask is used, it turns out that it does not increase more than the fixed quantity of light.

[0033] Moreover, the quantity of light cut mask 2 in the form of this operation It is made for a light guide to differ [a cross-section configuration / the path r1 by the side of the light guide of them (bore)] from the path (outer diameter) r2 of an opposite side by the wedge shape, as shown in drawing 1. Moreover, as it is made for r1 to become smallness from r2 and it becomes size from NA of a light guide 1 according to the difference of the bore to thickness d, and an outer diameter, it is made for the quantity of light cut function to have only a bore.

[0034] It is as follows when the concrete value of the bore r1 grade of a quantity of light cut mask is shown as an example of the light equipment of the form of this operation.

$d1=0.7\text{mm}$, $d2=2.3\text{mm}$, $r1=3.7\text{mm}$, $r2=5.7\text{mm}$ [0035] the light equipment of this example -- instead of [of the 150W above-mentioned metal halide lamp as a light source lamp] -- further -- high -- when a brightness lamp is used, it is necessary to make the bore r1 of a quantity of light cut mask into smallness from 3.7mm

[0036] In the form of the above-mentioned implementation, NA can fully make with the light of the amount of incident lights to the light equipment which the problem of generation of heat at the nose of cam of an endoscope moreover does not produce to the light guide of a thick path in size by selecting suitably the value of r1, r2, d1, and d2.

[0037] Moreover, with the brightness of the light source lamp to be used, the value of the above r1, r2, and d1 and d2 grade is selected to a suitable value, and realization of good light equipment is attained.

[0038] It is the ellipsoid mirror which reflects the flux of light to which 5 was carried out for example, from 150W metal halide lamp with the main light source lamp, and outgoing radiation of 6 was carried out [in / drawing 3 / drawing 3 is drawing showing the form of the 2nd operation of others of the lighting system for rigid mirrors of this invention, and] from the main light source lamp 5, and is condensed by the incidence edge of a light guide by this ellipsoid mirror 6. Drawing for 7 adjusting an infrared cut filter and 8 adjusting the outgoing radiation quantity of light and 10 are emergency light units. When the metal halide lamp 5 which is the main light source lamp is on, if a lamp 5 is no longer turned on by the life etc. optical path outside, this emergency light unit 10 will replace an infrared cut filter 7 automatically, and will be inserted into an optical path.

[0039] Drawing 4 is drawing showing a state when the emergency light unit 10 is inserted into an optical path. This emergency light unit 10 consists of the emergency light lamp and the ellipsoid mirror 12 of the halogen lamp 11. Moreover, by being arranged so that the longitudinal direction of an arc tube may become perpendicular to an optical axis, being able to shorten the optical path length, when an arc tube sets to the vertical sense in this way, and using the ellipsoid mirror 12, the emergency light lamp 11 is effective, when the optical path length for emergency light insertion cannot fully be taken. Therefore, not only an emergency light but the main light source side is not enlarged; but the whole light equipment can be miniaturized.

[0040] Moreover, the oblong ellipsoid mirror 12 is used so that the arc tube of the emergency light lamp 11 may be wrapped as optical system for emergency lights. A lateral path is 35mm, and NA of the reflected light by the ellipsoid mirror 12 satisfies about about 80% to NA0.66 of a light guide, and when this ellipsoid mirror 12 is illuminated according to the flux of light by which outgoing radiation is carried out from an endoscope nose of cam, it does not have darkly the circumference luminous intensity distribution of an observation visual field with a bird clapper.

[0041] Moreover, the outgoing beam from the light-emitting part of the emergency light lamp 11 is efficiently condensed by the incidence end face of a light guide by using an ellipsoid mirror.

[0042] As mentioned above, the light source for endoscope lighting of this example can make an emergency light unit compact, and can supply light of NA sufficient with sufficient quantity of light to a light guide. Moreover, the ellipsoid mirror which cannot take enough the space which an emergency light unit inserts can be used for this example by the main light source side, and it can miniaturize the whole light source.

[0043] Moreover, the configuration of an ellipsoid mirror is set up so that an emergency light unit can insert in the main light source side in the light equipment of this invention in an optical path and sufficient NA can be secured also to NA of a light guide.

[0044] The ellipsoid mirror used in this example gives an interference film to the ellipsoid of the glass substrate of the cross-section configuration by which glass fabrication was carried out and to illustrate, and gives a reflex function. Moreover, this interference film reflected the light of a visible region, and has prevented reflection of the light of an infrared region by making the light of an infrared region penetrate to some extent. That is, the infrared cut function is also given. However, in order that the wavelength field of light penetrated and reflected with the incident angle of the beam of light which carries out incidence to a film may shift an interference film, the spectral characteristic of the reflected light by the ellipsoid mirror 6 changes with the differences in NA of a beam of light which carry out incidence to a light guide a lot.

[0045] The thickness is becoming thick gradually towards the periphery of an ellipsoid mirror, the interference film given to the ellipsoid mirror 6 used in this example abolishes the difference of the part light reflex property in the core and periphery of an ellipsoid by this, and it is made for the spectral characteristic of the reflected light to become simultaneously regularity by the whole ellipsoid.

[0046] Moreover, in this example, it is made the business for which the infrared cut filter 7 which gave the interference film to the transparent glass substrate is arranged, and this infrared cut filter 7 and the infrared cut operation by the interference film given to the ellipsoid mirror 6 are doubled, that is, sufficient infrared cut is performed using the interference type infrared cut filter of two sheets.

[0047] That is, it is reflected by the infrared cut filter 7, and the infrared radiation which it cannot finish removing by the ellipsoid mirror 6 returns to the ellipsoid mirror 6, penetrates this ellipsoid mirror 6, and is removed out of an optical path. Moreover, generating of heat can also be prevented, without [therefore] infrared radiation repeating a multiple echo in an optical path.

[0048] As mentioned above, when this example also uses high brightness 150W metal halide lamp and applies it to the endoscope of a narrow light guide, supply of sufficient quantity of light is possible to an irradiated body.

[0049] Moreover, also in this example, the quantity of light cut mask 2 is formed near the light guide 1. Therefore, when it uses for the endoscope of a thick light guide, even if it uses the light source with high brightness, the quantity of light becomes size with this quantity of light cut mask, and there is no generation of heat of an endoscope point in a problem with a bird clapper.

[0050] Moreover, it is desirable for the amount of the light irradiated by area, an arrangement position, etc. of opening of a quantity of light cut mask at a light guide incidence end face to make it 2000 lumens or less. For example, by setting the bore r1 of a cut mask to 3.7mm like the aforementioned example 1, the quantity of light irradiated by the light guide incidence end face becomes about 2000 lumens.

[0051] It is as having stated above, and although indicated to a claim, as for the endoscope light equipment of this invention, the light equipment indicated in each term of other following can also attain the purpose of this invention.

[0052] (1) Endoscope light equipment characterized by being smaller than the path of the light guide which the bore of a quantity of light cut mask connects with the equipment indicated to the claim 1 of a claim, or 2.

[0053] (2) Endoscope light equipment characterized by the bore of a quantity of light cut mask being 4mm or less with the equipment indicated to the claim 1 of a claim, or 2.

[0054] (3) Endoscope light equipment to which the bore (path by the side of a light guide) is characterized by being smallness rather than an outer diameter with the equipment indicated to the claim 1 of a claim, or 2 by the acute angle [the inner direction] cross-section configuration [of a quantity of light cut mask] wedge shape.

[0055] (4) Endoscope light equipment whose condensing optical system is an ellipsoid mirror with the equipment indicated to the claim 3 of a claim.

[0056] (5) Endoscope light equipment characterized by making it become thick with the equipment indicated in the term of the above (4) as the ellipsoid mirror went the thickness of an interference

film by composition which prepared the interference film which gave the reflex function to the ellipsoid to the periphery from the optical axis.

[0057] (6) Endoscope light equipment characterized by the lamp for emergency lights being a halogen lamp with the equipment indicated to the claim 2 of a claim, above (4), or (5).

[0058] (7) Endoscope light equipment characterized by being arranged so that the longitudinal direction whose halogen lamp for emergency lights is an arc tube may become perpendicular to an optical axis with the equipment indicated in the aforementioned term of (6).

[0059]

[Effect of the Invention] Using the lamp of high brightness, to the endoscope using the narrow diameter light guide, the problem of generation of heat of a point does not produce it to the endoscope using the thick light guide by preparing a quantity of light cut mask near the incidence end face of a light guide while sufficient bright lighting is possible for the endoscope light equipment of this invention. Moreover, when an emergency light lamp is used for light equipment equipped with the emergency light of this invention, it can supply the light of sufficient quantity of light and NA.

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PRIOR ART

[Description of the Prior Art] In recent years, the long and slender insertion section is made to insert into a coelome, a coelome internal-organs machine is observed or the endoscope which can perform various medical treatment disposal using the disposal implement inserted into the disposal implement channel if needed is used widely.

[0003] The light guide which this endoscope leads the lighting light by which outgoing radiation was carried out from external light equipment to the insertion section, carries out outgoing radiation towards a photographic subject, and illuminates this is prepared.

[0004] The light equipment used here has the optical system for condensing the light which carries out outgoing radiation from a light source lamp, and leading to the incidence end face of a light guide.

[0005] The light guide which there is a thing of various sizes and is used for an endoscope also changes with endoscopes, and the size of an endoscope is also various. Generally, although a light guide is also thick and sufficient quantity of light for observation is obtained, in the case of a narrow endoscope, the light guide of a thick endoscope is also thin, and quantity of light sufficient for the reason is not obtained. Thus, although the f number of observation optical system is made into smallness and it is made to obtain luminosity sufficient as the whole endoscope system when quantity of light with it is not obtained, depth of field produce the fault which is not enough. [a thin light guide and] [sufficient]

[0006] Moreover, although light source lamps, such as a xenon, metal halide, and a halogen, are used for endoscope light equipment, there is a life in these light source lamp. Therefore, the light source lamp built in endoscope light equipment is turned off in the midst of inspection by the endoscope etc., and un-arranging of having to stop having to close inspection etc. starts.

[0007] In order to lose this un-arranging, when a light source lamp is turned off to light equipment, the light equipment which put the emergency light lamp side by side is known so that it can continue supplying lighting light to a lighting system. Such conventional endoscope light equipment with a built-in emergency light lamp consists of the reflective mirrors 22 and the source lamps 21 of emergency light photometry which are inserted into the optical path of main light source side 20, as shown in drawing 5, and it reflects the flux of light for lighting by the reflective mirror 22 with the source lamp of emergency light photometry, and it is made to lead it to the incidence end face of a light guide.

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TECHNICAL FIELD

[The technical field to which invention belongs] this invention relates to the endoscope light equipment for supplying lighting light to the light guide for lighting of an endoscope lighting system.

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EFFECT OF THE INVENTION

[Effect of the Invention] Using the lamp of high brightness, to the endoscope using the narrow diameter light guide, the problem of generation of heat of a point does not produce it to the endoscope using the thick light guide by preparing a quantity of light cut mask near the incidence end face of a light guide while sufficient bright lighting is possible for the endoscope light equipment of this invention. Moreover, when an emergency light lamp is used for light equipment equipped with the emergency light of this invention, it can supply the light of sufficient quantity of light and NA.

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] It is possible to use the high intensity lamp of high power for the increase in the quantity of light to the endoscope using the narrow diameter light guide. However, when the light equipment using such a high intensity lamp is applied to the endoscope using the thick light guide, the quantity of light which carries out outgoing radiation from an endoscope nose of cam becomes size, and generation of heat by the endoscope point becomes a problem.

[0009] There are various kinds of the light equipment used by the endoscope system, and the outgoing radiation quantity of lights also differ in each light equipment. Therefore, what is necessary is just to use a narrow light guide in accordance with the light equipment using the lamp of high brightness, in order to avoid the problem of generation of heat by the endoscope point. However, since the lighting quantity of light will run short and it will become dark if the light equipment of the lamp of low brightness is combined and used for the endoscope using such a narrow light guide, it cannot be used, and it is not desirable as the whole endoscope system.

[0010] Therefore, when it not only makes it the shortage of the quantity of light not arise, but combines with the endoscope using the thick light guide in the narrow endoscope especially using the narrow light guide combining the light equipment using the lamp of high brightness, it is necessary to make it the problem of generation of heat not arise, as lighting light of the quantity of light more than a constant rate is not supplied.

[0011] Moreover, in light equipment equipped with the above emergency light lamps, there was a fault that sufficient NA was not securable to a light guide, in the conventional equipment which inserts a reflective mirror into the optical path of the main light source as shown in drawing 5.

[0012] In light equipment equipped with the conventional emergency light lamp shown in drawing 5, in order to make the incidence end face of a light guide condense the flux of light which carries out outgoing radiation from the emergency light lamp 21, as shown in (B), using the ellipsoid mirror 23 as shown in (A) of drawing 5, it is necessary to use a condenser lens 24. When such the ellipsoid mirror 23 and a condenser lens 24 are used, sufficient optical path length is needed and all have the fault which cannot secure sufficient NA to NA of a light guide.

[0013] Moreover, in the light equipment shown in drawing 5, in order to secure sufficient NA to an emergency light side, not only an emergency light side but the main light source side becomes large-sized, and light equipment itself has the fault which becomes large-sized.

[0014] Therefore, when the main light source side lamp stops lighting up and it uses an emergency light lamp, in order that, as for the conventional example shown in drawing 5, the whole observation visual field not only becomes dark, but may carry out incidence only of the flux of light of a low NA to NA of a light guide, the observation visual field circumference becomes dark.

[0015] Therefore, there is a fault -- only an inadequate inspection result is obtained that it is hard to perform observation with a clear image in the cases, such as observation with an endoscope.

[0016] this invention offers the light equipment which the problem of generation of heat does not produce, when it is used for the endoscope equipped with the narrow light guide, and when it is used for the endoscope equipped with the thick light guide possible [supply of sufficient quantity of light].

[0017] Moreover, this invention is the thing equipped with the emergency light lamp used when lighting of the main lamp is impossible, when it switches an emergency light, it can supply sufficient

quantity of light and sufficient light of NA to the light guide for lighting, and it offers the light equipment of compact composition.

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MEANS

[Means for Solving the Problem] Incidence of the light equipment for endoscopes of this invention is carried out to a light guide from the plane of incidence from a light source lamp, and it is characterized by arranging the quantity of light cut mask for restricting the amount of incident lights near the plane of incidence of a light guide in the lighting system for endoscopes which is transmitted by this light guide, is made to carry out outgoing radiation from the outgoing radiation side, and illuminates a photographic subject.

[0019] It is characterized by making it the amount of incident lights to a light guide not exceed 2000 lumens (lumen) with the quantity of light cut mask for restricting especially the amount of incident lights.

[0020] that is, when using the light equipment of this invention as an object for endoscopes which has a narrow light guide, sufficient quantity of light is obtained -- as -- high, while using a brightness lamp In case incidence is carried out to a narrow light guide, when it is the area of opening which it does not have at all and incidence of the operation which intercepts light is moreover carried out to a thick light guide It is characterized by using the quantity of light cut mask which has the area of opening which can restrict the amount of incident lights to the grade from which generation of heat of an endoscope point does not become a problem, securing sufficient luminosity for the amount of incident lights by intercepting a part of light of the light source.

[0021] this invention will be because it checked that the amount of incident lights could be restricted to the value of simultaneously regularity, if the path of a light guide exceeds constant value by having been made based on the result which measured the amount of incidence to the light guide from which a path differs using the quantity of light cut mask of the area (path of opening) of fixed opening, and using this quantity of light cut mask so that it may explain in detail based on the gestalt of operation later.

[0022] Furthermore, as a result of measuring change of the calorific value of the endoscope point by increase of the amount of incident lights, when the amount of incident lights exceeds 2000 lumens, it is what calorific value became size and found out that it was not desirable on use, therefore it is most desirable to consider as the grade to which the amount of incident lights does not exceed about 2000 lumens using a quantity of light cut mask.

[0023] Moreover, the light equipment for endoscopes of this invention is set to the endoscope lighting system which make carry out incidence of the outgoing radiation light from light equipment, it is made to transmit and carry out outgoing radiation from the plane of incidence of a light guide, and illuminates a photographic subject. It is the thing equipped with the emergency light inserted between a light source lamp and a light guide, and this emergency light consists of a light source lamp and condensing optical system, and condensing optical system is characterized by making the path of the direction more nearly right-angled than the longitudinal direction of the bulb of a light source lamp to a longitudinal direction into size.

[0024] NA of the light which carries out incidence of the condensing optical system of an emergency light to the light guide of the light condensed by this right-angled direction by having made it size in the path of the longitudinal direction of the bulb of a light source lamp and a right-angled direction is made for the light equipment of this this invention to seldom become smallness to NA of a light guide, for example, it was made to become 70 percent or more.

[0025] By this, when it switches to an emergency light, comparatively big NA is maintained,

moreover, there is no emergency light with a bird clapper on a large scale, it is compact and a switch can make in easy composition.

[0026]

[Embodiments of the Invention] Next, the gestalt of operation of the light equipment of this invention is explained based on a drawing.

[0027] Drawing 1 is drawing in which showing the gestalt of operation of the 1st of this invention, and showing near the incidence end face of the light guide used for the endoscope of the light equipment of this invention, and on usual light equipment and parenchyma, since it is the same, the composition of a light source lamp etc. has been omitted.

[0028] In this drawing 1, when 1 combines a light guide and 2 combines light equipment, it is the quantity of light cut mask located near the incidence end face of this light guide 1, and in the light guide 1 of this quantity of light cut mask 2, the light source lamp which is not illustrated is located in an opposite side, and the light from this lamp carries out incidence to a light guide 1 through the opening 3 of a quantity of light cut mask.

[0029] High brightness 150W metal halide lamp is used so that the light source lamp used with the light equipment of the gestalt of this operation can supply sufficient quantity of light also to the endoscope of a narrow light guide.

[0030] When it uses for the endoscope of a narrow light guide by using such a lamp (lamp whose quantity of light is size enough) of high brightness, sufficient quantity of lighting light can be supplied. Moreover, since it may be made for the light which passes the opening 3 with the quantity of light cut mask 2, and carries out incidence to a light guide 1 not to become the quantity of light more than fixed when it is used as an object for the endoscopes of the thick light guide of a path by having the quantity of light cut mask 2, the problem of generation of heat of an endoscope point is not produced.

[0031] And in the case of the gestalt of this operation, it is able to make it, even if the path of a light guide becomes size by setting the path of a quantity of light cut mask to 3.7mm not to exceed 2000 lumens.

[0032] Drawing 2 is a graph which shows the path R of a light guide, and a relation with the quantity of light I. When a does not use a quantity of light cut mask in this graph, b shows the case where a quantity of light cut mask is used. As shown in this drawing, if a quantity of light cut mask is used, it turns out that it does not increase more than the fixed quantity of light.

[0033] Moreover, the quantity of light cut mask 2 in the gestalt of this operation It is made for a light guide to differ [a cross-section configuration / the path r1 by the side of the light guide of them (bore)] from the path (outer diameter) r2 of an opposite side by the wedge shape, as shown in drawing 1. Moreover, as it is made for r1 to become smallness from r2 and it becomes size from NA of a light guide 1 according to the difference of the bore to thickness d, and an outer diameter, it is made for the quantity of light cut function to have only a bore.

[0034] It is as follows when the concrete value of the bore r1 grade of a quantity of light cut mask is shown as an example of the light equipment of the gestalt of this operation.

$d1=0.7\text{mm}$, $d2=2.3\text{mm}$, $r1=3.7\text{mm}$, $r2=5.7\text{mm}$ [0035] the light equipment of this example -- instead of [of the 150W above-mentioned metal halide lamp as a light source lamp] -- further -- high -- when a brightness lamp is used, it is necessary to make the bore r1 of a quantity of light cut mask into smallness from 3.7mm

[0036] In the gestalt of the above-mentioned implementation, NA can fully make with the light of the amount of incident lights to the light equipment which the problem of generation of heat at the nose of cam of an endoscope moreover does not produce to the light guide of a thick path in size by selecting suitably the value of r1, r2, d1, and d2.

[0037] Moreover, with the brightness of the light source lamp to be used, the value of the above r1, r2, and d1 and d2 grade is selected to a suitable value, and realization of good light equipment is attained.

[0038] It is the ellipsoid mirror which reflects the flux of light to which 5 was carried out for example, from 150W metal halide lamp with the main light source lamp, and outgoing radiation of 6 was carried out [in / drawing 3 / drawing 3 is drawing showing the gestalt of the 2nd operation of others of the lighting system for rigid mirrors of this invention, and] from the main light source

lamp 5, and is condensed by the incidence edge of a light guide by this ellipsoid mirror 6. Drawing for 7 adjusting an infrared cut filter and 8 adjusting the outgoing radiation quantity of light and 10 are emergency light units. When the metal halide lamp 5 which is the main light source lamp is on, if a lamp 5 is no longer turned on by the life etc. optical path outside, this emergency light unit 10 will replace an infrared cut filter 7 automatically, and will be inserted into an optical path.

[0039] Drawing 4 is drawing showing a state when the emergency light unit 10 is inserted into an optical path. This emergency light unit 10 consists of the emergency light lamp and the ellipsoid mirror 12 of the halogen lamp 11. Moreover, by being arranged so that the longitudinal direction of an arc tube may become perpendicular to an optical axis, being able to shorten the optical path length, when an arc tube sets to the vertical sense in this way, and using the ellipsoid mirror 12, the emergency light lamp 11 is effective, when the optical path length for emergency light insertion cannot fully be taken. Therefore, not only an emergency light but the main light source side is not enlarged, but the whole light equipment can be miniaturized.

[0040] Moreover, the oblong ellipsoid mirror 12 is used so that the arc tube of the emergency light lamp 11 may be wrapped as optical system for emergency lights. A lateral path is 35mm, and NA of the reflected light by the ellipsoid mirror 12 satisfies about about 80% to NA0.66 of a light guide, and when this ellipsoid mirror 12 is illuminated according to the flux of light by which outgoing radiation is carried out from an endoscope nose of cam, it does not have darkly the circumference luminous intensity distribution of an observation visual field with a bird clapper.

[0041] Moreover, the outgoing beam from the light-emitting part of the emergency light lamp 11 is efficiently condensed by the incidence end face of a light guide by using an ellipsoid mirror.

[0042] As mentioned above, the light source for endoscope lighting of this example can make an emergency light unit compact, and can supply light of NA sufficient with sufficient quantity of light to a light guide. Moreover, the ellipsoid mirror which cannot take enough the space which an emergency light unit inserts can be used for this example by the main light source side, and it can miniaturize the whole light source.

[0043] Moreover, the configuration of an ellipsoid mirror is set up so that an emergency light unit can insert in the main light source side in the light equipment of this invention in an optical path and sufficient NA can be secured also to NA of a light guide.

[0044] The ellipsoid mirror used in this example gives an interference film to the ellipsoid of the glass substrate of the cross-section configuration by which glass fabrication was carried out and to illustrate, and gives a reflex function. Moreover, this interference film reflected the light of a visible region, and has prevented reflection of the light of an infrared region by making the light of an infrared region penetrate to some extent. That is, the infrared cut function is also given. However, in order that the wavelength field of light penetrated and reflected with the incident angle of the beam of light which carries out incidence to a film may shift an interference film, the spectral characteristic of the reflected light by the ellipsoid mirror 6 changes with the differences in NA of a beam of light which carry out incidence to a light guide a lot.

[0045] The thickness is becoming thick gradually towards the periphery of an ellipsoid mirror, the interference film given to the ellipsoid mirror 6 used in this example abolishes the difference of the part light reflex property in the core and periphery of an ellipsoid by this, and it is made for the spectral characteristic of the reflected light to become simultaneously regularity by the whole ellipsoid.

[0046] Moreover, in this example, it is made the business for which the infrared cut filter 7 which gave the interference film to the transparent glass substrate is arranged, and this infrared cut filter 7 and the infrared cut operation by the interference film given to the ellipsoid mirror 6 are doubled, that is, sufficient infrared cut is performed using the interference type infrared cut filter of two sheets.

[0047] That is, it is reflected by the infrared cut filter 7, and the infrared radiation which it cannot finish removing by the ellipsoid mirror 6 returns to the ellipsoid mirror 6, penetrates this ellipsoid mirror 6, and is removed out of an optical path. Moreover, generating of heat can also be prevented, without [therefore] infrared radiation repeating a multiple echo in an optical path.

[0048] As mentioned above, when this example also uses the high brightness 150 <DP N=0005> W metal halide lamp and applies it to the endoscope of a narrow light guide, supply of sufficient

quantity of light is possible to an irradiated body.

[0049] Moreover, also in this example, the quantity of light cut mask 2 is formed near the light guide 1. Therefore, when it uses for the endoscope of a thick light guide, even if it uses the light source with high brightness, the quantity of light becomes size with this quantity of light cut mask, and there is no generation of heat of an endoscope point in a problem with a bird clapper.

[0050] Moreover, it is desirable for the amount of the light irradiated by area, an arrangement position, etc. of opening of a quantity of light cut mask at a light guide incidence end face to make it 2000 lumens or less. For example, by setting the bore r_1 of a cut mask to 3.7mm like the aforementioned example 1, the quantity of light irradiated by the light guide incidence end face becomes about 2000 lumens.

[0051] It is as having stated above, and although indicated to a claim, as for the endoscope light equipment of this invention, the light equipment indicated in each term of other following can also attain the purpose of this invention.

[0052] (1) Endoscope light equipment characterized by being smaller than the path of the light guide which the bore of a quantity of light cut mask connects with the equipment indicated to the claim 1 of a claim, or 2.

[0053] (2) Endoscope light equipment characterized by the bore of a quantity of light cut mask being 4mm or less with the equipment indicated to the claim 1 of a claim, or 2.

[0054] (3) Endoscope light equipment to which the bore (path by the side of a light guide) is characterized by being smallness rather than an outer diameter with the equipment indicated to the claim 1 of a claim, or 2 by the acute angle [the inner direction] cross-section configuration [of a quantity of light cut mask] wedge shape.

[0055] (4) Endoscope light equipment whose condensing optical system is an ellipsoid mirror with the equipment indicated to the claim 3 of a claim.

[0056] (5) Endoscope light equipment characterized by making it become thick with the equipment indicated in the term of the above (4) as the ellipsoid mirror went the thickness of an interference film by composition which prepared the interference film which gave the reflex function to the ellipsoid to the periphery from the optical axis.

[0057] (6) Endoscope light equipment characterized by the lamp for emergency lights being a halogen lamp with the equipment indicated to the claim 2 of a claim, above (4), or (5).

[0058] (7) Endoscope light equipment characterized by being arranged so that the longitudinal direction whose halogen lamp for emergency lights is an arc tube may become perpendicular to an optical axis with the equipment indicated in the aforementioned term of (6).

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Drawing showing the composition of the 1st of the gestalt of operation of this invention

[Drawing 2] The graph which shows the relation of the diameter of a light guide and the quantity of light in the gestalt of the 1st operation

[Drawing 3] Drawing showing the composition of the 2nd of the gestalt of operation of this invention

[Drawing 4] Drawing showing the composition of the emergency light used with the gestalt of operation of the 2nd of this invention

[Drawing 5] Drawing showing the composition of conventional endoscope light equipment

[Description of Notations]

- 1 Light Guide
- 2 Quantity of Light Cut Mask
- 5 The Main Light Source Lamp
- 6 Ellipsoid Mirror
- 7 Infrared Cut Filter
- 10 Emergency Light Unit
- 11 Emergency Light Lamp
- 12 Ellipsoid Mirror

[Translation done.]

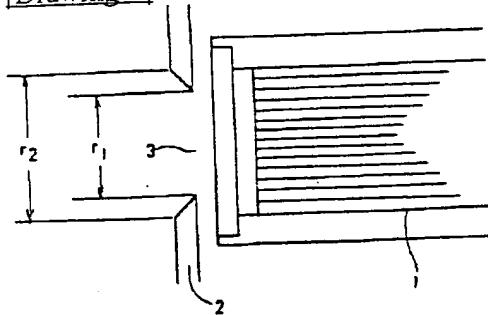
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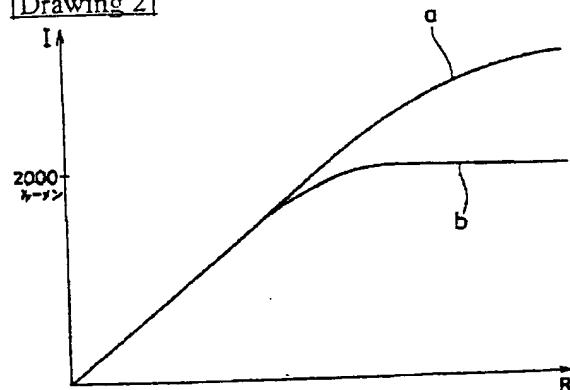
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DRAWINGS

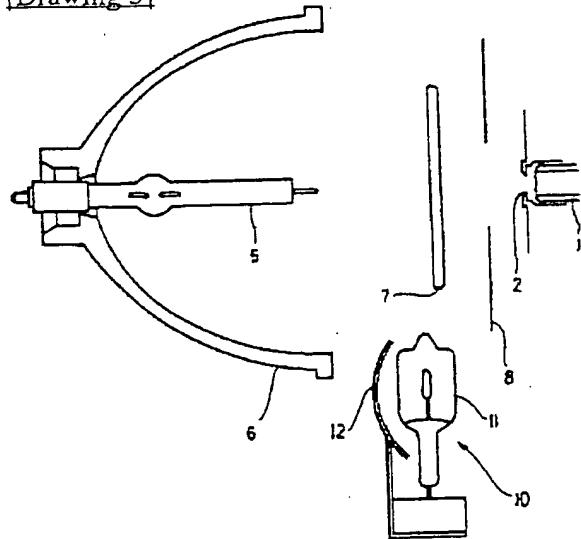
[Drawing 1]



[Drawing 2]



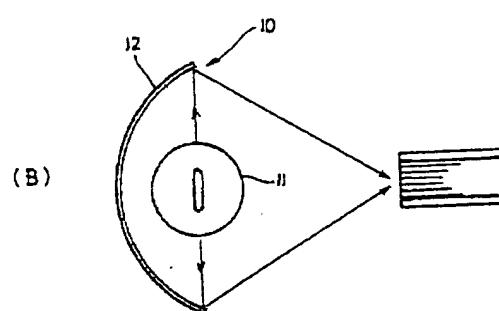
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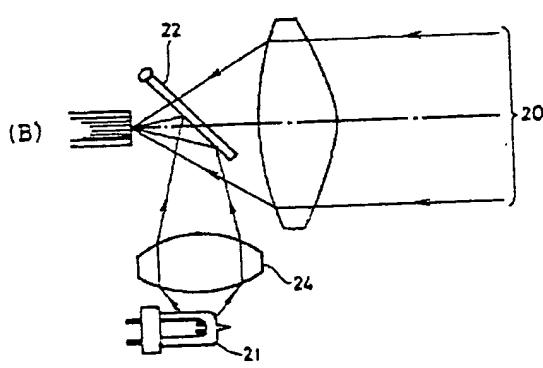
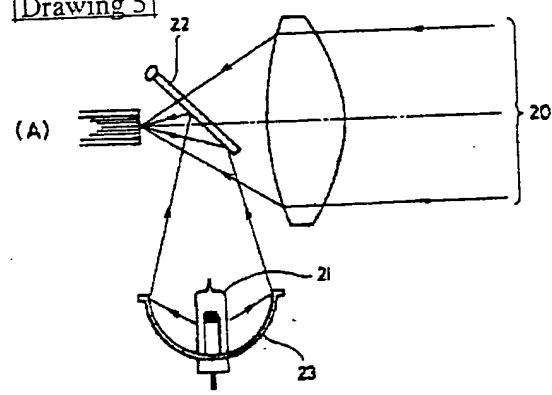
[Drawing 4]



(A)



[Drawing 5]



[Translation done.]

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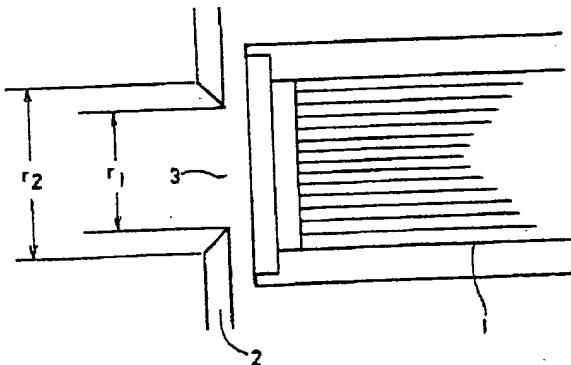
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(54)【発明の名称】内視鏡光源装置

(57)【要約】

【課題】 細いライトガイドの内視鏡においても十分な光量が得られ、又太いライトガイドの内視鏡に使用した時に発熱の問題が生じないようにする。

【解決手段】 ライトガイドの入射端面近傍に、入射光量を制限するための光量カットマスクを配置した。



【特許請求の範囲】

【請求項1】 光源ランプからの出射光をライトガイドを介して被写体に出射、照明する内視鏡光源装置において、前記ライトガイドの入射端面近傍にライトガイドへの入射光量を制限するための光量カットマスクを前記ライトガイドの入射端直前に配置したことを特徴とする内視鏡光源装置。

【請求項2】 前記光量カットマスクを前記ライトガイドへの入射光量が2000ルーメン以下になるような構成にしたことを特徴とする請求項1の内視鏡光源装置。

【請求項3】 光源ランプからの出射光をライトガイドを介して被写体に出射、照明する内視鏡照明システムにおいて、前記光源ランプとライトガイドとの間に挿入される他の第2の光源ランプと集光光学系とよりなる非常灯を備え、前記第2の光源ランプの発光管の長手方向よりも長手方向に垂直な方向の径が大であり、長手方向より垂直な方向より集光されるライトガイドへの入射NAがライトガイドのNAの7割以上であることを特徴とする内視鏡光源装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は、内視鏡照明装置の照明用ライトガイドに照明光を供給するための内視鏡光源装置に関するものである。

【0002】

【従来の技術】 近年、体腔内に細長い挿入部を挿入させて体腔内臓器を観察したり、必要に応じて処置具チャネル内に挿入された処置具を用いて各種治療処置を行ない得る内視鏡が広く利用されている。

【0003】 この内視鏡は、外部の光源装置から出射された照明光を挿入部に導き被写体に向けて出射しこれを照明するライトガイドが設けられている。

【0004】 ここで用いられる光源装置は、光源ランプから出射する光を集光してライトガイドの入射端面に導くための光学系を有している。

【0005】 内視鏡は、様々な太さのものがあり、又、内視鏡に用いられるライトガイドも内視鏡により異なりその太さも様々である。一般に、太い内視鏡はライトガイドも太く、観察に十分な光量が得られるが、細い内視鏡の場合、ライトガイドも細く、そのために十分な光量が得られない。このようにライトガイドが細く十分な光量が得られない場合、観察光学系のFナンバーを小にして内視鏡システム全体として十分な明るさを得るようにしているが、被写界深度が十分でない欠点を生ずる。

【0006】 又、内視鏡光源装置には、キセノン、メタルハライド、ハロゲン等の光源ランプが用いられるが、これら光源ランプには寿命がある。そのため、内視鏡による検査等の最中に、内視鏡光源装置に内蔵されている光源ランプが切れ検査等を打ち切らなければならなくな

るという不都合がおこる。

【0007】 この不都合をなくすために、光源装置に光源ランプが切れた時に照明装置に照明光を供給し続けることができるよう、非常灯ランプを併設した光源装置が知られている。このような非常灯ランプ内蔵の従来の内視鏡光源装置は、図5に示すように主光源側20の光路中に挿入される反射ミラー22と非常灯側光源ランプ21により構成され、非常灯側光源ランプにより照明用光束を反射ミラー22にて反射させてライトガイドの入射端面に導くようにしている。

【0008】

【発明が解決しようとする課題】 細径のライトガイドを用いた内視鏡に対する光量の増加のために、高電力の高輝度ランプを用いることが考えられる。しかし、このような高輝度ランプを用いた光源装置を太いライトガイドを用いた内視鏡に対して適用した場合、内視鏡先端から出射する光量が大になり、内視鏡先端部での発熱が問題になる。

【0009】 内視鏡システムにて使用される光源装置には様々な種類があり、出射光量も各光源装置において異なっている。そのために内視鏡先端部での発熱の問題を回避するためには、高輝度のランプを用いた光源装置にあわせて細いライトガイドを用いればよい。しかし、このような細いライトガイドを用いた内視鏡に低輝度のランプの光源装置を組み合わせ使用すると照明光量が不足し暗くなるため使用できず、内視鏡システム全体として好ましくない。

【0010】 したがって、高輝度のランプを用いた光源装置と組み合わせて、特に細いライトガイドを用いた細い内視鏡においても光量不足が生じないようにするだけでなく、太いライトガイドを用いた内視鏡と組み合わせた場合に、一定量以上の光量の照明光を供給しないようにして発熱の問題が生じないようにする必要がある。

【0011】 又、前述のような、非常灯ランプを備えた光源装置において、図5に示すような主光源の光路中に反射ミラーを挿入する従来の装置においては、ライトガイドに対して十分なNAを確保できないという欠点があった。

【0012】 図5に示す従来の非常灯ランプを備えた光源装置において、非常灯ランプ21から出射する光束をライトガイドの入射端面に集光させるためには、図5の(A)に示すような楕円面鏡23を用いるか、(B)に示すように集光レンズ24を用いる必要がある。このような楕円面鏡23や集光レンズ24を用いた場合、いずれも十分な光路長が必要になり、ライトガイドのNAに対して十分なNAを確保できない欠点がある。

【0013】 又、図5に示す光源装置において、非常灯側において十分なNAを確保するためには、非常灯側のみならず主光源側も大型になり、光源装置そのものが大型になる欠点を有する。

【0014】そのため、図5に示す従来例は、主光源側ランプが点灯しなくなり、非常灯ランプを用いる場合、観察視野全体が暗くなるだけでなく、ライトガイドのNAに対して低いNAの光束しか入射しないために、観察視野周辺が暗くなる。

【0015】そのため内視鏡での観察等の際に明瞭な像での観察を行ないにくく不十分な検査結果しか得られない等の欠点がある。

【0016】本発明は、細いライトガイドを備えた内視鏡に使用したときも十分な光量の供給が可能であり、又10 太いライトガイドを備えた内視鏡に使用したときも発熱の問題の生じない光源装置を提供するものである。

【0017】又、本発明は、主ランプの点灯不能の際に用いる非常灯ランプを備えたもので、非常灯を切り換えた際も照明用ライトガイドに対して十分な光量と十分なNAの光を供給し得、しかもコンパクトな構成の光源装置を提供するものである。

【0018】

【課題を解決するための手段】本発明の内視鏡用光源装置は、光源ランプからライトガイドにその入射面より入射させ、このライトガイドにより伝送されその出射面より出射させて被写体を照明する内視鏡用照明システムにおいて、ライトガイドの入射面近傍に入射光量を制限するための光量カットマスクを配置することを特徴とする。

【0019】特に入射光量を制限するための光量カットマスクによりライトガイドへの入射光量が2000ルーメン(lumen)を超えないようにしたことを特徴とする。

【0020】即ち、本発明の光源装置は、細いライトガイドを有する内視鏡用として使用する場合も、十分な光量が得られるように高輝度なランプを使用すると共に、細いライトガイドへ入射させる際には光を遮断する作用を全く有しない開口の面積であって、しかも太いライトガイドへ入射させるときには、光源の光の一部を遮断することによって入射光量を十分な明るさを確保しつつ内視鏡先端部の発熱が問題にならない程度まで入射光量を制限し得る開口の面積を有する光量カットマスクを用いたことを特徴とする。

【0021】本発明は、後に実施の形態にもとづいて詳細に説明するように、一定の開口の面積(開口の径)の光量カットマスクを用いて径の異なるライトガイドへの入射量の測定を行なった結果にもとづきなされたもので、この光量カットマスクを用いることにより、ライトガイドの径が一定値を超えると入射光量をほぼ一定の値に制限し得ることを確認したことによる。

【0022】更に入射光量の増大による内視鏡先端部の発熱量の変化を測定した結果、入射光量が2000ルーメンを超えると発熱量が大になり使用上好ましくないことを見出したもので、したがって、光量カットマスクを

用いて、入射光量がほぼ2000ルーメンを超えない程度とすることが最も望ましい。

【0023】又本発明の内視鏡用光源装置は、光源装置からの出射光をライトガイドの入射面より入射させて伝送し、出射させて被写体を照明する内視鏡照明システムにおいて、光源ランプとライトガイドの間に挿入される非常灯を備えたもので、この非常灯が光源ランプと集光光学系とよりなり、集光光学系が光源ランプのバルブの長手方向よりも長手方向に直角な方向の径を大にしたことを特徴としている。

【0024】この本発明の光源装置は、非常灯の集光光学系を光源ランプのバルブの長手方向と直角な方向の径を大にしたことによりこの直角な方向により集光される光のライトガイドへ入射する光のNAをライトガイドのNAに対してあまり小にならないようにし、例えば7割以上になるようにした。

【0025】これによって、非常灯に切り換えた際も比較的大きなNAを保ち、しかも非常灯が大型になることなくコンパクトで切り替えが容易な構成になし得る。

【0026】

【発明の実施の形態】次に本発明の光源装置の実施の形態を図面にもとづき説明する。

【0027】図1は本発明の第1の実施の形態を示すもので、本発明の光源装置のうちの内視鏡に用いられるライトガイドの入射端面付近を示す図で、光源ランプ等の構成は、通常の光源装置と実質上同じであるため省略してある。

【0028】この図1において、1はライトガイド、2は光源装置を組み合わせたときにこのライトガイド1の入射端面付近に位置する光量カットマスクで、この光量カットマスク2のライトガイド1とは反対側には図示していない光源ランプが位置し、このランプよりの光が光量カットマスクの開口部3を通過してライトガイド1に入射する。

【0029】この実施の形態の光源装置で用いられる光源ランプは、細いライトガイドの内視鏡に対しても十分な光量を供給し得るように高輝度150Wメタルハライドランプが用いられている。

【0030】このような高輝度のランプ(光量が十分大であるランプ)を用いることにより細いライトガイドの内視鏡に用いた場合も十分な量の照明光を供給できる。又光量カットマスク2を備えることにより径の太いライトガイドの内視鏡用として使用した場合も光量カットマスク2によりその開口部3を通過してライトガイド1に入射する光が一定以上の光量にならないようにし得るので、内視鏡先端部の発熱の問題は生じない。

【0031】そしてこの実施の形態の場合、光量カットマスクの径を3.7mmにすることにより、ライトガイドの径が大になつても2000ルーメンを超えることがないようにすることが可能である。

【0032】図2は、ライトガイドの径Rと光量Iとの関係を示すグラフである。このグラフにおいてaは光量カットマスクを用いない場合、又bは光量カットマスクを用いた場合を示す。この図のように、光量カットマスクを用いれば、一定光量以上には増加しないことがわかる。

【0033】又、この実施の形態における光量カットマスク2は、図1に示すように断面形状が楔状でそのうちのライトガイド側の径(内径) r_1 がライトガイドと反対側の径(外径) r_2 とが異なるようにし、又 r_1 が r_2 より小になるようにし、厚さdに対する内径と外径の差によりライトガイド1のNAよりも大になるようにして光量カット機能が内径のみになるようにしてある。

【0034】この実施の形態の光源装置の実施例として光量カットマスクの内径 r_1 等の具体的な値を示すと次の通りである。

$$d_1 = 0.7 \text{ mm}, d_2 = 2.3 \text{ mm}, r_1 = 3.7 \text{ mm}, r_2 = 5.7 \text{ mm}$$

【0035】この実施例の光源装置で、光源ランプとして前述の150Wメタルハライドランプの代りに更に高輝度なランプを用いた場合、光量カットマスクの内径 r_1 を3.7mmより小にする必要がある。

【0036】上記実施の形態において、 r_1 、 r_2 、 d_1 、 d_2 の値を適宜選定することにより十分に入射光量の光で、NAが大でしかも太い径のライトガイドに対しても内視鏡先端の発熱の問題の生じない光源装置に至る。

【0037】又、使用する光源ランプの輝度によって、前記 r_1 、 r_2 、 d_1 、 d_2 等の値を適切な値に選定して良好な光源装置の実現が可能になる。

【0038】図3は、本発明の硬性鏡用照明装置の他の第2の実施の形態を示す図で、図3において5は主光源ランプで例えば150Wメタルハライドランプ、6は主光源ランプ5より出射された光束を反射する楕円面ミラーで、この楕円面ミラー6によりライトガイドの入射端に集光される。7は赤外線カットフィルター、8は出射光量を調整するための絞り、10は非常灯ユニットである。この非常灯ユニット10は、主光源ランプであるメタルハライドランプ5が点灯しているときは、光路外におかれ、寿命等によりランプ5が点灯しなくなると自動的に赤外線カットフィルター7と入れ替わって光路中に挿入される。

【0039】図4は、非常灯ユニット10が光路中に挿入された時の状態を示す図である。この非常灯ユニット10はハロゲンランプ11の非常灯ランプと楕円面ミラー12とよりなる。又非常灯ランプ11は、発光管の長手方向が光軸に対して垂直になるように配置され、このように発光管が縦向きにおかれることにより光路長を短縮でき、又楕円面ミラー12を用いることにより、非常灯挿入のための光路長が十分にとれない場合に有効である。

る。そのため、非常灯のみならず、主光源側も大型化せず、光源装置全体を小型化し得る。

【0040】また、非常灯用光学系として非常灯ランプ11の発光管を包むように横長の楕円面ミラー12が用いられている。この楕円面ミラー12は、横方向の径が35mmで、楕円面ミラー12による反射光のNAは、ライトガイドのNA0.66に対し約80%近くを満足し、内視鏡先端から出射される光束により照明した際、観察視野の周辺配光が暗くなることはない。

10 【0041】また、楕円面ミラーを用いることにより非常灯ランプ11の発光部からの出射光束は、効率よくライトガイドの入射端面に集光される。

【0042】以上のように、この実施例の内視鏡照明用光源は、非常灯ユニットをコンパクトにでき、かつ十分な光量で十分なNAの光をライトガイドに供給し得る。又、この実施例は、非常灯ユニットが挿入するスペースが十分取れない楕円面ミラーを主光源側で使用でき光源全体を小型化できる。

20 【0043】又、本発明の光源装置における主光源側は、非常灯ユニットが光路中に装入可能であり、かつライトガイドのNAに対しても十分なNAを確保できるように楕円面ミラーの形状が設定されている。

【0044】この実施例で用いられている楕円面ミラーは、ガラス成形された図示する断面形状のガラス基板の楕円面に対して干渉膜を施して反射機能を持たせたものである。また、この干渉膜は、可視領域の光を反射し、赤外領域の光をある程度透過させることによって赤外領域の光の反射を防止している。つまり赤外カット機能も持たせている。しかし、干渉膜は膜に入射する光線の入射角によって透過および反射する光の波長領域がシフトするため、ライトガイドへ入射する光線のNAの違いによって楕円面ミラー6による反射光の分光特性が大きく変化する。

30 【0045】この実施例で用いる楕円面ミラー6に施した干渉膜は、その膜厚が楕円面ミラーの周辺部へ向けて徐々に厚くなっている。これによって楕円面の中心部と周辺部との分光反射特性の差をなくし、楕円面全体で反射光の分光特性がほぼ一定になるようにしている。

【0046】又、この実施例では、透明なガラス基板に干渉膜を施した赤外線カットフィルター7を配置し、この赤外線カットフィルター7と楕円面ミラー6に施した干渉膜による赤外線カット作用とを合わせつまり2枚の干渉タイプの赤外線カットフィルターを用いて十分な赤外線カットが行なわれる用にしている。

40 【0047】即ち、楕円面ミラー6にて除ききれない赤外線は、赤外線カットフィルター7にて反射されて楕円面ミラー6に戻り、この楕円面ミラー6を透過して光路外に除去される。又赤外線が光路中で多重反射を繰り返すことなく、したがって熱の発生も防止し得る。

50 【0048】前述のように、この実施例も高輝度150

Wメタルハライドランプを用いており、細いライトガイドの内視鏡に適用した場合も、被照射物体に対し十分な光量の供給が可能である。

【0049】また、この実施例においても、ライトガイド1の近傍に光量カットマスク2が設けてある。したがって、太いライトガイドの内視鏡に用いた場合、輝度の高い光源を用いてもこの光量カットマスクにより光量が大になって内視鏡先端部の発熱が問題になることはない。

【0050】又、光量カットマスクの開口部の面積や配置位置等により、ライトガイド入射端面に照射される光の量が2000ルーメン以下にすることが望ましい。例えば前記実施例1のようにカットマスクの内径 r_1 を3.7mmとすることにより、ライトガイド入射端面に照射される光量は、ほぼ2000ルーメンになる。

【0051】本発明の内視鏡光源装置は、以上述べた通りで、特許請求の範囲に記載するもののほか下記の各項に記載する光源装置も本発明の目的を達成し得る。

【0052】(1) 特許請求の範囲の請求項1又は2に記載する装置で、光量カットマスクの内径が接続するライトガイドの径よりも小さいことを特徴とする内視鏡光源装置。

【0053】(2) 特許請求の範囲の請求項1又は2に記載する装置で、光量カットマスクの内径が4mm以下であることを特徴とする内視鏡光源装置。

【0054】(3) 特許請求の範囲の請求項1又は2に記載する装置で、光量カットマスクの断面形状が内方に鋭角な楔状でその内径(ライトガイド側の径)が外径よりも小であることを特徴とする内視鏡光源装置。

【0055】(4) 特許請求の範囲の請求項3に記載する装置で、集光光学系が楕円面ミラーである内視鏡光源装置。

【0056】(5) 前記(4)の項に記載する装置で、楕円面ミラーが楕円面に反射機能を持たせた干渉膜を設けた構成で、干渉膜の膜厚を光軸から周辺部にいくにつれて厚くなるようにしたことを特徴とする内視鏡光

源装置。

【0057】(6) 特許請求の範囲の請求項2あるいは前記の(4)又は(5)に記載する装置で、非常灯用ランプがハロゲンランプであることを特徴とする内視鏡光源装置。

【0058】(7) 前記の(6)の項に記載する装置で、非常灯用のハロゲンランプが発光管の長手方向が光軸に対して垂直になるように配置されていることを特徴とする内視鏡光源装置。

【0059】

【発明の効果】本発明の内視鏡光源装置は、ライトガイドの入射端面近傍に光量カットマスクを設けることにより、高輝度のランプを用いて、細径のライトガイドを用いた内視鏡に対して十分な明るい照明が可能であると共に太いライトガイドを用いた内視鏡に対しても先端部の発熱の問題が生じない。又本発明の非常灯を備えた光源装置は、非常灯ランプを用いた際にも十分な光量とNAの光を供給し得るものである。

【図面の簡単な説明】

【図1】 本発明の第1の実施の形態の構成を示す図

【図2】 第1の実施の形態におけるライトガイド径と光量との関係を示すグラフ

【図3】 本発明の第2の実施の形態の構成を示す図

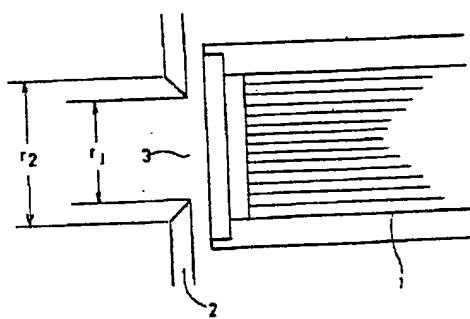
【図4】 本発明の第2の実施の形態にて用いる非常灯の構成を示す図

【図5】 従来の内視鏡光源装置の構成を示す図

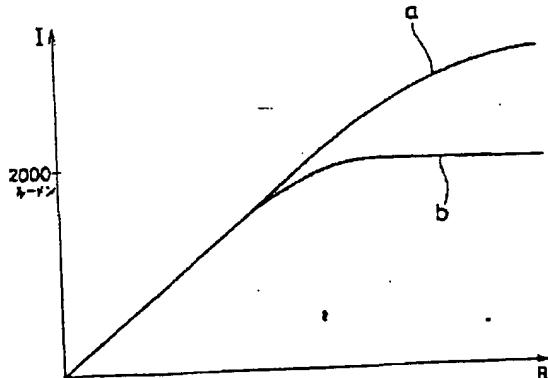
【符号の説明】

1	ライトガイド
2	光量カットマスク
5	主光源ランプ
6	楕円面ミラー
7	赤外線カットフィルター
10	非常灯ユニット
11	非常灯ランプ
12	楕円面ミラー

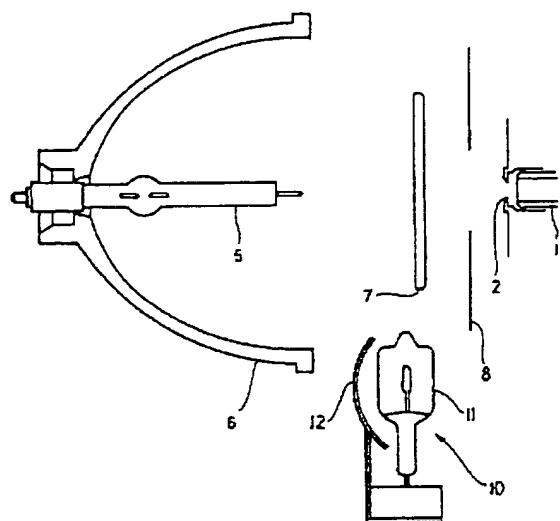
【図1】



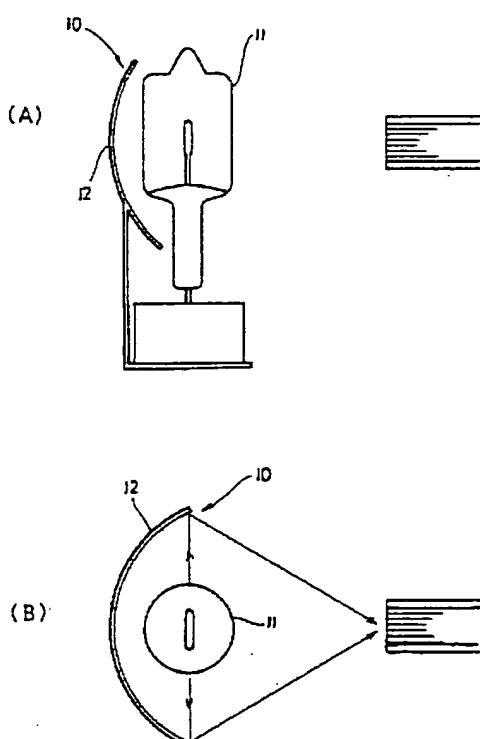
【図2】



【図 3】



【図 4】



【図 5】

